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## Orbit Determination at Eros: NEAR Spacecraft Dynamics and Initial Results

*J.D. Giorgini, J.K. Miller, P.G. Antreasian, B.G. Williams, C.E. Helfrich, W.M. Owen, Jr., T.C. Wang, D.K. Yeomans, E. Carranza, S.R. Chesley (Jet Propulsion Laboratory)*

The NEAR spacecraft was maneuvered into a 366x321 km capture trajectory around minor planet (433) Eros on February 14, 2000. Determination and prediction of the spacecraft's motion about the elongated (33x17x13 km) central body provides a richly coupled problem in dynamics due to Eros' ephemeris uncertainties, Eros' weak, non-uniform gravity field, the initially uncertain Eros spin-state, and the influence of solar gravity and radiation pressure on the spacecraft.

A brief review of the mission to date and discussion of the general orbit stability problem is given. This is followed by description of the orbit determination strategy as it relates to a global solution for Eros' gravity field in terms of spherical and elliptical harmonic representations.

Six observational data types have been used simultaneously to solve for these dynamical parameters. They include two-way coherent Doppler, ranging, differenced Doppler, optical surface landmarks, optical center of mass estimates, and the star background.

Initial results, including estimates of the mass parameter, bulk density, pole direction, prime meridian, gravity harmonics and inertia tensor are presented. During the initial orbital phase there is little sensitivity to even low-order gravity harmonics. As the spacecraft moves to lower altitudes, this sensitivity will improve. Plans call for an eventual 35 km circular orbit with specially designed close passes that will come within 1 km of Eros' surface prior to nominal mission end in February, 2001.

**Presentation Type:** ORAL

**Submitter:** Jon D. Giorgini

**Member ID:** 20392

**Presenter email address:** Jon.Giorgini@jpl.nasa.gov

**Presenter phone:** 818-393-3107

**Correspondent address:** Jet Propulsion Laboratory M/S 301-150 4800 Oak Grove Drive  
Pasadena, CA 91109

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